READINESS STATEMENT
STS-103/ET-101
EXTERNAL TANK PROJECT
PRE-FLIGHT WIRING REVIEW

EXTERNAL TANK ET-101/STS-103, AS IDENTIFIED IN THE EXTERNAL TANK PROJECT PRE-FLIGHT WIRING REVIEW DATED NOVEMBER 1, 1999, IS CONSIDERED READY TO SUPPORT FLIGHT UPON ACCEPTABLE DISPOSITION OF OPEN/PLANNED WORK AND/OR OPEN ACTIONS.

J. BULLMAN/ED10

for A. F. WHITAKER/ED30

For A. O. GOODSON/QS01

For D. L. DUMBACHER/ED20

for G. R. WALLACE/ED40

J. L. LUSK/MP31

J. C. MONK/TD01

P. V. COUNTS/MP31, CHAIRMAN

November 8, 1999

Space Shuttle
External Tank

STS-103/ET-101
Pre-Flight Review

101pfr.4250.dd.11/99

Agenda

Overview	***Jim Feeley***
Current Mission/External Tank Highlights	
ET-101 Mass Properties Status	Rick Spring
Changes	
Special Topics	
• STS-99/ET-92 Pre-Flight Review Action Item – Critical Process Changes	Jim Feeley
• Weld Instruction Card (WIC) Certification	Don Bolstad
• ET Electrical Harness Investigation	Leed Colon
• ET/SRB Cross-Strap Harness Removal/ Replacement	
Senior Management Review NCDs: None	
SRM&QA Assessment	Mike Bankester
KSC Processing	Juan Ramirez
Verification/Certification	Jim Feeley
Mission Unique Assessment	
Readiness Statement	
Appendices	
• A: Minor Changes	
• B: NCD Assessment Criteria	
• C: KSC Processing	
• D: Level II Exceptions/Waivers and Level III Deviations	
• E: Items previously reviewed for STS-99/ET-92	

101pfr.4250.dd.10/99

Overview

This review for STS-103/ET-101 includes:

- Items specific to mission STS-103
- First time changes, differences and "out-of-family" non-conformances not previously flown and/or reviewed
  - STS-99/ET-92 previously scheduled to fly before STS-103/ET-101
    - STS-99 Pre-Flight Review (9/1/99) included items applicable to ET-92 and ET-101
    - Common items will not be re-addressed in this Pre-Flight Review
    - Items are included in Appendix E, *Items Previously Presented for STS-99*

FRR Series

• ET/SRB Mate Review	08/24/1999
• Pre-Flight Review	11/08/1999
• Space Shuttle Vehicle FRR	11/19/1999
• Mission Management Team	12/05/1999

Mission Management Simulation 11/18/1999

Mission/External Tank Highlights

Mission	**STS-103**
Launch	12/07/1999 (Under review)
• Window	TBD
• Pad	B
• Orbiter	Discovery (OV-103)
• Orbital Inclination	28.45° - Insertion at 317 NM
• ET Photo Coverage	• Crew photos from cockpit window • Umbilical well cameras • SRB cameras
Primary Payload	Hubble Servicing Mission 3
Landing	12/17/1999 (Under review)
• Time	TBD
• Location	KSC
External Tank	**ET-101**
DD250 Acceptance	11/25/1998
Shipped to Launch Site	01/15/1999

101pfr.4250.dd.10/99

Agenda

Overview	Jim Feeley
Current Mission/External Tank Highlights	
ET-101 Mass Properties Status	***Rick Spring***
Changes	
Special Topics	
• STS-99/ET-92 Pre-Flight Review Action Item	Jim Feeley
– Critical Process Changes	
• Weld Instruction Card (WIC) Certification	Don Bolstad
• ET Electrical Harness Investigation	Leed Colon
• ET/SRB Cross-Strap Harness Removal/ Replacement	
Senior Management Review NCDs: None	
SRM&QA Assessment	Mike Bankester
KSC Processing	Juan Ramirez
Verification/Certification	Jim Feeley
Mission Unique Assessment	
Readiness Statement	
Appendices	
• A: Minor Changes	
• B: NCD Assessment Criteria	
• C: KSC Processing	
• D: Level II Exceptions/Waivers and Level III Deviations	
• E: Items previously reviewed for STS-99/ET-92	

101pfr.4250.dd.10/99

ET-101 Mass Properties Status

ET-101 Specification Weight = 58,470 lbs

- ET-101 was weighed 02/08/1999 @ KSC
  - Predicted 58,337 lbs
  - As-weighed 58,465 lbs
  - Delta +128 lbs
- Level II uses "as-weighed" data for mission planning
- ET-101 was weighed with compression platform scales at KSC
  - Suspect PR written on KSC weighing system due to scale platform interference
  - PR disposition in work that invalidates ET-101 actual weight
- LMMSS recommends using predicted weight for mission planning
  - MMC-ET-SE40, ET Project - Mass Properties Weight and Balance Report, will be resubmitted to note that ET-101 as-weighed data is suspect (ECD 11/12/99)
- Preliminary coordination with Level II indicates approximately 12,000 lb performance margin for STS-103
  - No issues for mission planning

101pfr.4250.dd.10/99

Agenda

Overview	Jim Feeley
Current Mission/External Tank Highlights	
ET-101 Mass Properties Status	Rick Spring
Changes	
Special Topics	
• STS-99/ET-92 Pre-Flight Review Action Item	Jim Feeley
– Critical Process Changes	
• Weld Instruction Card (WIC) Certification	Don Bolstad
• ET Electrical Harness Investigation	Leed Colon
• ET/SRB Cross-Strap Harness Removal/ Replacement	
Senior Management Review NCDs: None	
SRM&QA Assessment	Mike Bankester
KSC Processing	Juan Ramirez
Verification/Certification	Jim Feeley
Mission Unique Assessment	
Readiness Statement	
Appendices	
• A: Minor Changes	
• B: NCD Assessment Criteria	
• C: KSC Processing	
• D: Level II Exceptions/Waivers and Level III Deviations	
• E: Items previously reviewed for STS-99/ET-92	

101pfr.4250.dd.10/99

Changes

- **Response to MIL-Spec Cancellations (B02047)** — Roseann Gray
- **LH2 Tank changes to accommodate SSME Block II implementation (B02034)** — Mike Quiggle
- **Intertank thrust panel foam loss corrective actions** — Eugene Sweet
  - Vent thrust panel foam (FEC KET-0054 and R1)
  - Vent additional thrust panel foam and +Z skin/stringer panel foam (FEC KET-0056)

Response to MIL-Spec Cancellations

Change

- Created and implemented a document which lists alternate specifications for cancelled MIL-Specs

Background

- Aerospace industry has historically used U.S. government, military and federal specifications, and standards (MIL-Specs) in design and manufacture
- U.S. government Acquisition Reform legislation has resulted in cancellation of U.S. Government, military and federal specifications and standards
- ET engineering requirement documents (such as drawings, standards, engineering material and process specifications) specify over 350 MIL-Specs
- LMMSS reviewed engineering requirement documents for reference to MIL-Specs
- Significant effort would be required to revise all engineering requirement documents referencing the cancelled/inactive MIL-Specs
  - LMMSS initiated activity to approve replacement specifications
  - Material Sciences 'Senior Review' Committee established to review and approve replacement specifications for cancelled MIL-specs
  - Weekly meetings conducted to review alternates for technical equivalence
  - Specifications not considered equivalent will be processed through normal change processing system

Response to MIL-Spec Cancellations

Description

- Created book form collector drawing (809-3600) which lists technically equivalent, alternate specifications for cancelled/inactive MIL-Specs
  - Added drawing reference to top ET assembly level drawings and to Exhibit A for supplier documentation requirements
- Revise ET Materials and Processes Control Plan (SE-16) to add reference to 809-3600 as the collector document for identification of alternate specifications
- Updates to collector occur as potential alternates are approved by the Material Sciences 'Senior Review Committee'

Basis for Certification

- Similarity - Technical review of alternate specification is conducted to confirm that identified specifications are technically equivalent to the cancelled specifications

LH2 Tank Changes for SSME Block II Implementation

Change

- Increased pre-launch ullage pressure requirement to accommodate SSME Block II Implementation
  - ET GH2 vent/relief valve requirements revised for higher pre-press level
    - No design change required
    - Reseat pressure
      - Was: 34.0 psig minimum
      - Now: 34.25 psig minimum
    - Acceptance test instrumentation and requirements revised
  - Perform post proof weld x-ray requirements on additional 215 inches of under proofed LH2 tank circumferential welds

Reason

- Advanced high pressure fuel turbopump in the Block II SSME has increased preburner temperature spikes during engine start transient causing reduced turbine blade life
  - Required modification of the ET pre-pressurization control bands and LH2 ullage pressure ICD
  - Raised pre-pressurization control band will be used only on flights with three Block II SSMEs
    - ***Not required for STS-103/ET-101***

LH2 Tank Changes for SSME Block II Implementation

Basis for Certification

- **Test and Inspection**
  - Successful completion of LH2 tank proof test and post-proof inspection
    - 215 inches of additional weld inspected
  - No change to critical test demonstrated LH2 tank Factor of Safety
  - Raised LH2 tank pre-press band was demonstrated on STS-91 tanking test
    - Narrow band with 0.5 second GHe bursts was demonstrated
    - Pre-press level demonstrated was 0.3 psi lower than planned for use with three Block II SSMEs
- **Analysis**
  - Propulsion analysis shows LH2 tank ullage pressure will be within LCC limits during pre-press
  - Structural analysis shows overall critical factor of safety unchanged
    - Factor of Safety for critical circumferential welds (failure mode: ultimate tension)

				Proof Test Demonstrated	
Weld ID	*Required*	*Was*	*Now*	*Was*	*Now*
• LH2 Tank H4	1.25	1.51	1.45	1.24	1.25
• LH2 Tank H5	1.25	1.49	1.42	1.25	1.25

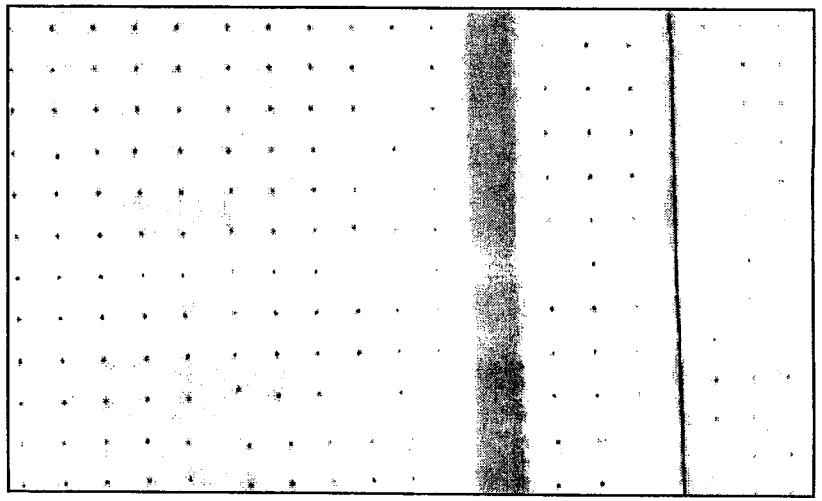
Intertank Thrust Panel Foam Loss Corrective Actions

Change

- Vent portions of the Intertank thrust panel and skin/stringer panel foam
  - 0.032" diameter pin holes are spaced 0.30" apart

Background

- Post flight inspection of STS-87 revealed out-of-family damage to the Orbiter tiles caused by foam loss from the ET Intertank thrust panel
- A rigorous test program has demonstrated the potential for vented foam to reduce popcorn-type debris
- Vented foam configuration has been certified by test and analysis to do no harm
- Venting of Intertank foam implemented on STS-96/ET-100 and STS-93/ET-99
- Review of SRB video following STS-96/ET-100 showed less debris with vented foam
- Based upon STS-96/ET-100 data and additional analysis, area of Intertank thrust panel foam to be vented was increased for STS-93/ET-99

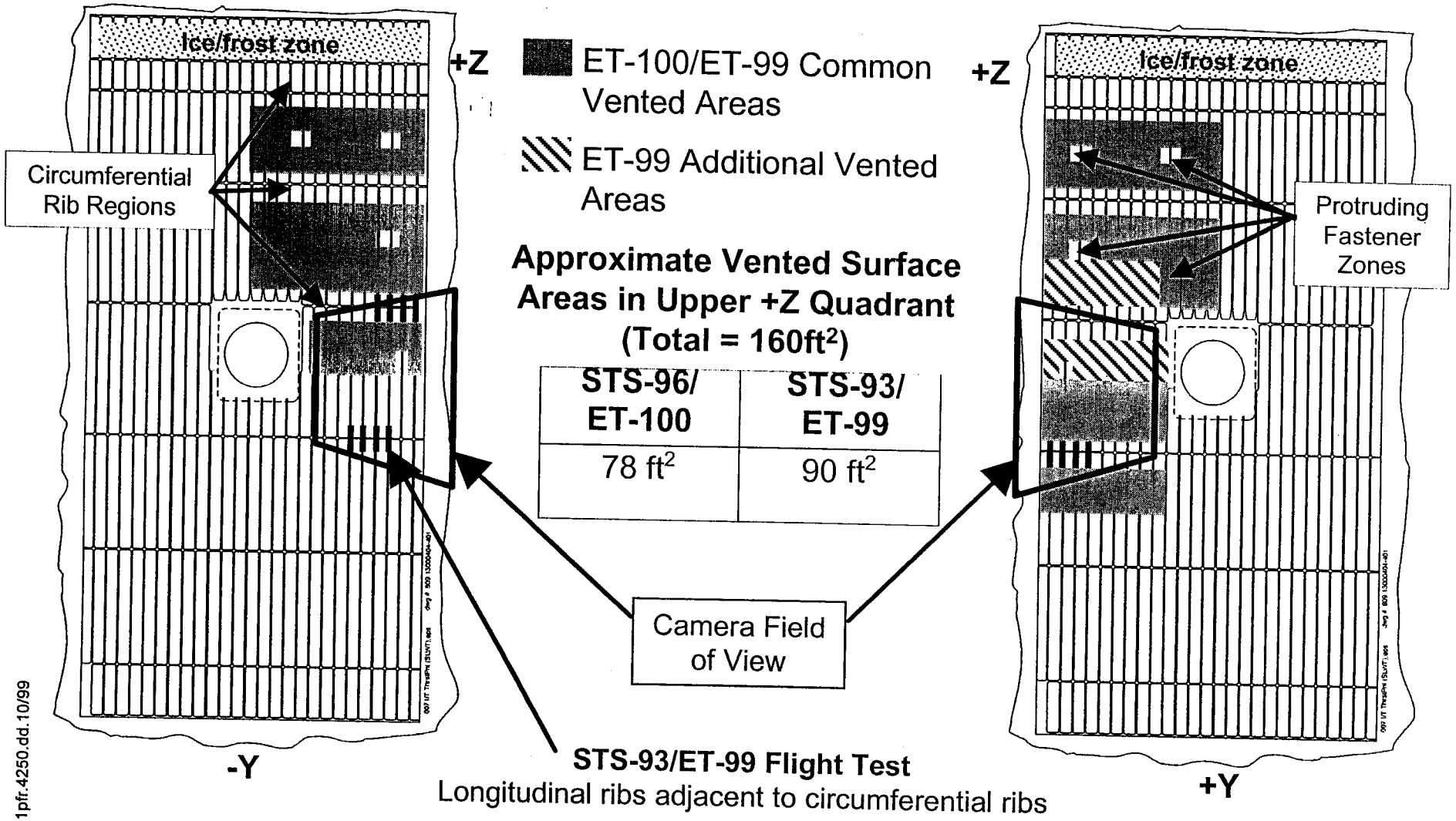


Typical Vented Foam Configuration

101pfr.4250.dd.10/99

Intertank Thrust Panel Foam Loss Corrective Actions

Background (continued)

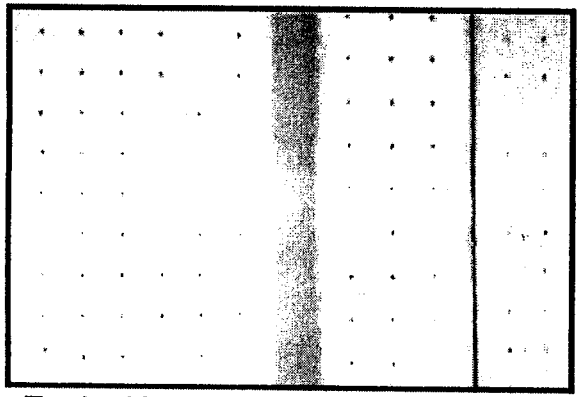


101pfr.4250.dd.10/99

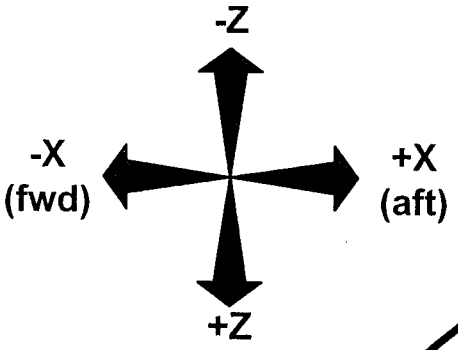
Intertank Thrust Panel Foam Loss Corrective Actions

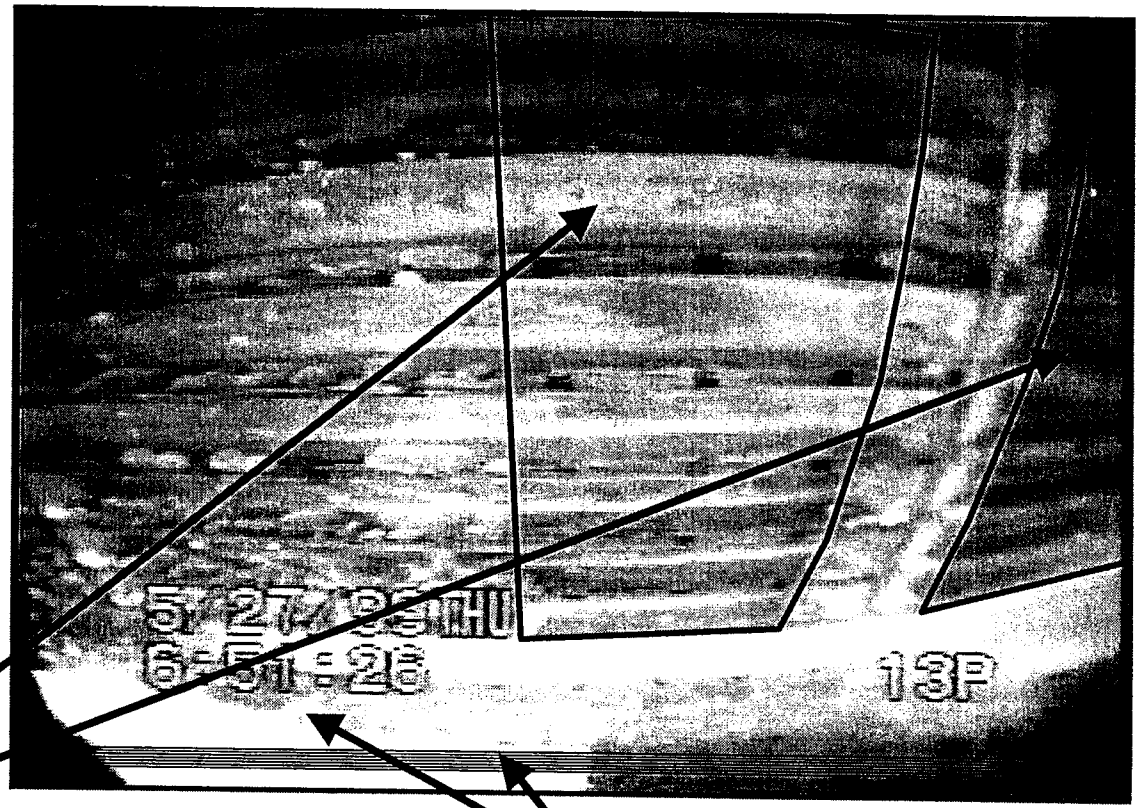
Background (continued)

- Review of STS-93/ET-99 SRB flight video confirmed performance enhancement realized through foam venting
  - Popcorning exhibited on Intertank skin/stringer foam



Typical Vented Foam Configuration





Vented Area on STS-96/ET-100 +Y Thrust Panel

Foam Loss on Skin/Stringer Areas

Intertank Thrust Panel Foam Loss Corrective Actions

Description of Change

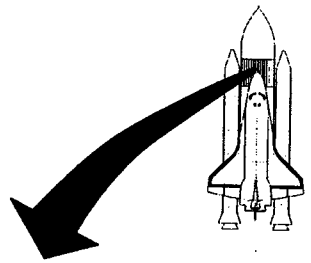
- Perform venting of Intertank foam areas
  - Combination of BNA-identified debris zone and areas of observed foam loss
  - Areas of potential ice-formation and unmachined foam excluded

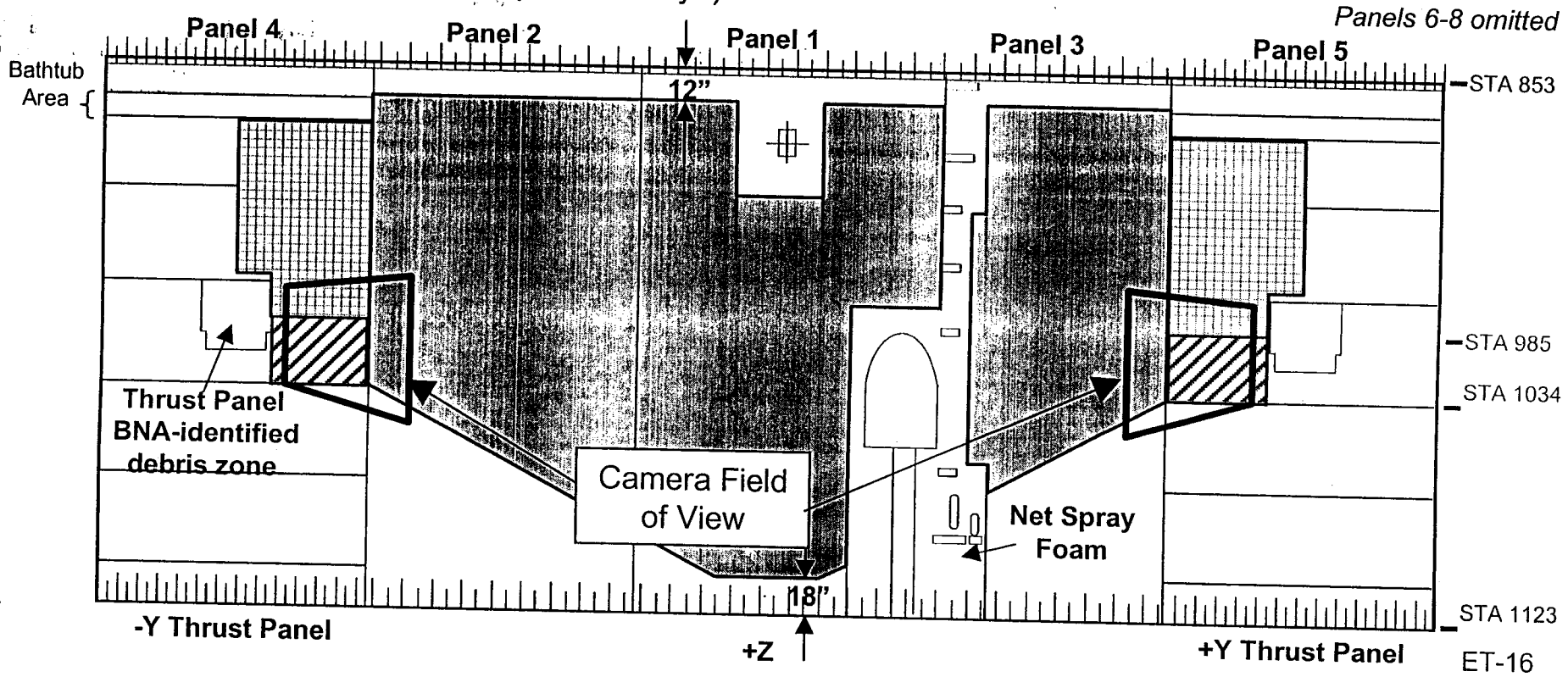
Vented thrust panel area in BNA-identified debris zone = 90 ft²

Vented thrust panel area outside of BNA-identified debris zone = 12 ft²

Vented skin/stringer areas = 725 ft²

Unvented BNA-identified debris zone = 36 ft²
(8 ft² bathtubs, 18 ft² ramps, 10 ft² cryo)





101pfr.4250.dd.10/99

Intertank Thrust Panel Foam Loss Corrective Actions

Basis for Certification

- Primary test facilities used were MSFC Hot Gas and Thermal/Vacuum--the best discriminators of popcorn performance
- Popcorning performance of additional rib and skin/stringer configurations similar to that of previously successfully vented thrust panel configurations
- NASA/LMMSS IFA team reviewed test results indicates that venting of rib locations adjacent to circumferential rib ramps and skin/stringer panel areas are certified "to do no harm"
- No safety of flight concerns

Intertank Thrust Panel Foam Loss Corrective Actions

Basis for Certification

- Test
  - Tests performed in different test beds following various environmental conditioning
  - Results from all performance testing show that vented foam performs as well as or better than the non-vented foam configuration and measurably reduces foam loss
- Similarity
  - Vented foam configuration similar to configuration flown on STS-96/ET-100 and STS-93/ET-99

Certification Test	No. of Tests	Humidity	Salt Fog	Vented
Vented Foam Certification Testing				
Mechanical Properties/Acceptance Testing				
Density	200			X
Bond Tension	540	X	X	X
Flatwise Tension	540	X	X	X
Lap Shear	360	X		X
Plug Pulls	144		X	X
Flexure (Ribbed panels)	24	X		X
Thermal Properties				
Thermal Conductivity	24	X	X	X
Flight Verification				
Hot Gas - Flat Panels, Machined foam	20	X	X	X
Hot Gas - Rib Panels, Machined foam	63	X	X	X
Hot Gas - Skin/stringer, Machined foam	7	X		X
Thermal/Vacuum, Flat Panels, Machined foam	40	X	X	X
Thermal/Vacuum, Single Rib Panels, Machined foam	14			X
Thermal/Vacuum, Rib Panels, Machined foam	24	X	X	X
Thermal/Vacuum, Skin/stringer, Machined foam	8	X		X
Wind Tunnel (AEDC), Machined foam	4			X
Vibro/Acoustic Test (DOE C Addendum Testing)	6	X		X
Process Verification/Acceptance				
Full-Scale Process Pathfinder (GVTA)	1			X

Agenda

Overview	Jim Feeley
Current Mission/External Tank Highlights	
ET-101 Mass Properties Status	Rick Spring
Changes	
Special Topics	
• ***STS-99/ET-92 Pre-Flight Review Action Item***	***Jim Feeley***
– ***Critical Process Changes***	
• Weld Instruction Card (WIC) Certification	Don Bolstad
• ET Electrical Harness Investigation	Leed Colon
• ET/SRB Cross-Strap Harness Removal/ Replacement	
Senior Management Review NCDs: None	
SRM&QA Assessment	Mike Bankester
KSC Processing	Juan Ramirez
Verification/Certification	Jim Feeley
Mission Unique Assessment	
Readiness Statement	
Appendices	
• A: Minor Changes	
• B: NCD Assessment Criteria	
• C: KSC Processing	
• D: Level II Exceptions/Waivers and Level III Deviations	
• E: Items previously reviewed for STS-99/ET-92	

STS-99/ET-92 Pre-Flight Review Action Item

Action Item

- Develop and document criteria for critical processes and present how critical process changes are controlled

Response

- Definition of critical processes is documented in NSTS 5300.4 (1D-2)

  A material process (I.e., a process which changes the chemical/ physical properties of a material) which could have a significant performance effect on hardware identified on the CIL (Critical Items List), hardware designated for fracture control and ordnance, and where design conformance cannot be assured by inspection.

STS-99/ET-92 Pre-Flight Review Action Item

Response

- External Tank critical processes are consistent with critical process definition in NSTS 5300.4
  - Forming & Fabrication of Metals
  - Forming & Fabrication of Non-metals
  - Fasteners
  - Non-Destructive Evaluation
  - Finishes
  - Testing
  - Lubrication
  - Identification & Packaging
  - Cleaning & Contamination Control
  - Welding, Brazing & Soldering
  - Adhesive/Bonding
  - Electrical and Electronic Fabrication
  - Sealing & Potting
  - Composites
  - Heat Treat
- Adequate controls in place to ensure adequate review and control of process changes
  - MAF processes
  - Supplier processes
  - Facilities and tooling processes

STS-99/ET-92 Pre-Flight Review Action Item

Process Change Control

- Current change system used for changes in process requirements is same system used for preparation/review/release of all engineering changes

  - Process changes initiated by Technical Operations/Material Sciences
    - Initiated as a result of in-house/supplier liaison calls, NASA direction, industry developments, etc.
  - Proposed process change is prepared/reviewed by appropriate MAF disciplines
    - Procurement (coordinates with Suppliers)
    - Production Operations
    - Environmental/Facilities
    - Quality/Safety
    - Technical Operations
    - Contracts
  - Change release
    - Contracts verifies authority for release, ensuring contract compliance
    - Release of engineering change concurrent with manufacturing process change
    - Released change forwarded to NASA Materials, Processes, and Manufacturing
  - Process changes are included in readiness review process
    - Not ET specific - Change is briefed prior to a potential effectivity

STS-99/ET-92 Pre-Flight Review Action Item

Supplier Process Change Control (Flowed Down to Supplier)

- Following process revision, Procurement Quality reviews specification to determine if changes are mandatory for Supplier
- If mandatory, Materiel Operations (Buyer) directs Supplier to incorporate change
  - Supplier incorporates change and provides modified Process Instruction (PI) to Procurement Quality Control Field Representative for review
    - Critical processes and PI violating LMMSS process requirements are routed to Buyer via Documentation Acceptance Sheet (DAS)
      - Processes meeting LMMSS process requirements can be approved by Field Representative
    - Buyer routes DAS/PI for review
      - Product Technical Support
      - Material Sciences
      - Systems Engineering
      - Procurement Quality
    - If adequate, approved DAS/PI is routed back to supplier along with validation/re-validation requirements

STS-99/ET-92 Pre-Flight Review Action Item

Supplier Process Change Control (Flow Up from Supplier)

- If Supplier desires to change PI, Supplier provides a modified PI to Procurement Quality Control Field Representative for review
  - Field Representative coordinates with MAF Procurement Quality to determine appropriate action
    - Activities similar to Process Requirements Flow Down
      - e.g. DAS, validation/revalidation requirements, etc.
- Other process changes (i.e. those which would not necessarily involve a PI change) are required to be coordinated through LMMSS
  - LMMSS reviews changes for adequacy and provides validation/revalidation requirements
- For "sixth-buy" procurement, Suppliers are required to provide/maintain Process Flow Charts
  - Process Flow Charts illustrate the sequence in which PI are used at Supplier
  - LMMSS reviews changes for adequacy

STS-99/ET-92 Pre-Flight Review Action Item

Facilities & Tooling (associated with ET manufacture) Change Control

- Operational Readiness Reviews are conducted to review facilities and tooling changes

- Mission Success/Safety reviews scope of change to identify what type of Operational Readiness Inspection (ORI) is warranted
  - ORI verifies readiness of flight article, Facilities, Tooling, procedures, and personnel to perform specified operations
  - ORI attendees include NASA representatives

- Facilities and tooling changes associated with major ET design changes are presented and reviewed in the readiness reviews

STS-99/ET-92 Pre-Flight Review Action Item

Summary

- LMMSS change control management systems encompass supplier, sub-tier, and on-site operations and provide end-to-end oversight
  - Process changes are evaluated and reviewed to ensure successful implementation

- LMMSS systems and management practices are designed to ensure that no unplanned changes occur

- Process changes included in this readiness review are not ET specific
  - Change is briefed prior to a potential effectivity

Critical Process Changes

B02042-001 and B02042-012

- ***Not implemented on ET-101***
- ***Will be implemented on NCD for first use (NET ET-113)***
  - ***Use will be presented to/and approved by FCB and SMR***

- **Change Description**
  - Release STP 5510 (Friction Plug Weld Repair) to incorporate a solid state weld repair process
  - Revise STP 2506 (Ultrasonic Inspection of Weldments) to incorporate ultrasonic inspection of friction plug repair welds
- **Reason**
  - Increase process reliability and weld repair strength
- **Basis for Certification**
  - SDS friction plug repair development program
  - Fracture Control Board (MAF & MSFC) review/approval
  - FPW repair mechanical property allowables
    - Plug tensile
    - Simulated service and surface crack tension
    - Three point and tension fatigue
    - Peaking and mismatch
    - T and X intersection proof tests
    - Heat repairs on plugs plug tensile
  - SDS inspection technique development

To be presented in detail for first implementation as a Senior Management Review NCD

101pfr.4250.dd.10/99

Agenda

Overview	
Current Mission/External Tank Highlights	Jim Feeley
ET-101 Mass Properties Status	
Changes	Rick Spring
Special Topics	
• STS-99/ET-92 Pre-Flight Review Action Item	
– Critical Process Changes	Jim Feeley
• ***Weld Instruction Card (WIC) Certification***	***Don Bolstad***
• ET Electrical Harness Investigation	Leed Colon
• ET/SRB Cross-Strap Harness Removal/ Replacement	
Senior Management Review NCDs: None	
SRM&QA Assessment	
KSC Processing	Mike Bankester
Verification/Certification	Juan Ramirez
Mission Unique Assessment	Jim Feeley
Readiness Statement	
Appendices	
• A: Minor Changes	
• B: NCD Assessment Criteria	
• C: KSC Processing	
• D: Level II Exceptions/Waivers and Level III Deviations	
• E: Items previously reviewed for STS-99/ET-92	

101pfr.4250.dd.10/99

Weld Instruction Card (WIC) Certification

Issue

- During a recent weld schedule review, it was determined that several of the weld schedules may have been incorrectly certified

Background

- Weld certification requirements are established through Engineering process requirements documents
  - Certification requirements verify that weld schedules produce acceptable weld strengths and quality
  - Requirements are then restated and implemented in the "how to" manufacturing process documents
- Ambiguity of the weld process documents and reliance on institutional knowledge led to instances of incomplete testing for weld certification

Weld Instruction Card (WIC) Certification

Background

- Performed LMMSS Quality and Engineering review of all "as-built" ET welds
  - Discrepancies were documented on non-conformance documents (NCDs)
  - Each NCD was individually analyzed, dispositioned and approved by LMMSS and NASA/MSFC
  - When necessary, additional welded panels were fabricated and tested
  - All discrepant weld schedules were reviewed to the correct certification condition
  - All NCDs were dispositioned and approved
- No safety of flight issues have been identified

Actions Taken to Resolve Non-Conformances

- LMMSS and NASA/MSFC conducted a review (October - present) of all ET welding processes
  - Several findings were noted during the review that require resolution
    - 0 Category 1 Findings: Require immediate implementation before welding can continue
    - 19 Category 2 Findings: Require rapid implementation in accordance with a waterfall strategy
    - 30 Category 3 Findings: Would be implemented into weld operations on a non-interference basis

Weld Instruction Card (WIC) Certification

One Additional Issue Identified During the NASA/LMMSS Review

- Concern for design strength of welds (cryogenic properties) due to effect of weld parameter variations
- NASA/LMMSS Team reviewed the possible impact on ET-101

ET-101 Rationale for Flight

- Team conducted a review of the following and determined that adequate rationale existed for ET-101 clearance:
  - Weld-by-weld reviews
  - Review of as-built parameter charts
  - ET-101 as-delivered weld tests
  - Parameter range test data
  - Wide panel and confidence panel data
  - Fracture property review
  - Proof test stresses and history
  - Flight stress analysis
- LMMSS and NASA/MSFC Review Team concluded that there was no safety of flight concerns

WIC Issue Previously Presented To:

- Lead Center Program Managers Council on 09/10/99
- Daily PRCB (Mr. McMonagle) on 9/28/99
- Special Presentation to Mr. Dittemore on 10/19/99
- Program Managers' Preventive/Corrective Action Review on 11/05/99
  - Final root cause will be presented to Chief Engineers Council

Agenda

Overview	Jim Feeley
Current Mission/External Tank Highlights	
ET-101 Mass Properties Status	Rick Spring
Changes	
Special Topics	
• STS-99/ET-92 Pre-Flight Review Action Item	Jim Feeley
– Critical Process Changes	
• Weld Instruction Card (WIC) Certification	Don Bolstad
• ***ET Electrical Harness Investigation***	***Leed Colon***
• ***ET/SRB Cross-Strap Harness Removal/ Replacement***	
Senior Management Review NCDs: None	
SRM&QA Assessment	Mike Bankester
KSC Processing	Juan Ramirez
Verification/Certification	Jim Feeley
Mission Unique Assessment	
Readiness Statement	
Appendices	
• A: Minor Changes	
• B: NCD Assessment Criteria	
• C: KSC Processing	
• D: Level II Exceptions/Waivers and Level III Deviations	
• E: Items previously reviewed for STS-99/ET-92	

ET Electrical Wire Harness Investigation

Actions Taken

- External Tank Project conducted an in-depth review to ensure adequate safeguards and continued safe operation for flight
- The following items were reviewed:
  - Harness design, fabrication and installation
  - Final acceptance and checkout
  - Post fabrication and installation harness disposition
  - KSC inspection, checkout and acceptance
- Investigation showed that ET cabling design, fabrication and installations have adequate safe guards to ensure continued safe operation
  - Some enhancements were identified

Enhancements

• Expand certification of fabricators/installers	ECD 1/00
• Shield termination/splice improvement	
– Meltable Liners	ECD 5/00
– Solder Sleeves	
• Re-evaluate following study and development	ECD 1/01
• Redesign of cable support tools to incorporate protective enclosure	ECD 06/00
• Design of cable protection tool at KSC	Complete
• Long term action - P-clamp cushion configuration	ECD 1/04
– Improved design (box-cushion) will be incorporated in next procurement	

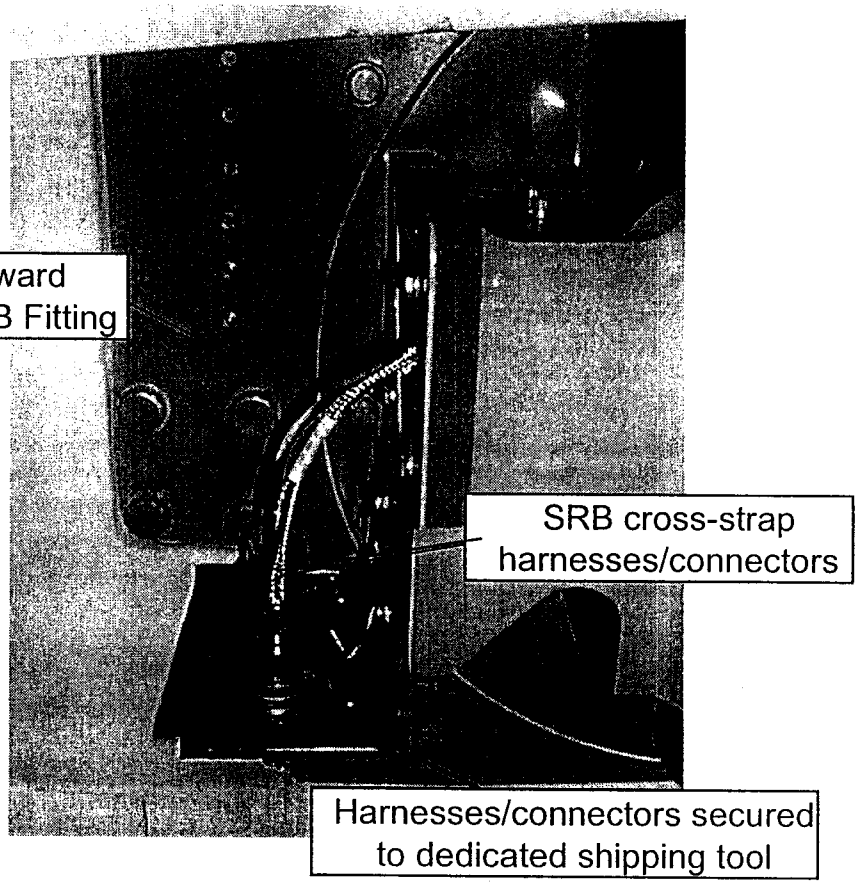
ET/SRB Cross-Strap Harness Removal/Replacement

Issue

- Damaged +Y ET/SRB cross-strap harness on STS-103/ET-101

Background

- Prior to forward crossover installation, procedure specifies performance of a pre-mate inspection of cable connectors
  - Inspection of STS-103/ET-101 revealed a damaged overall shield of +Y ET/SRB cross-strap harness
  - Damage approximately 5 inches from face of connector
  - Visual inspection indicated 3-5 broken shield strands and damaged wire identification tag
  - Subsequent tactile inspection detected a damaged Kapton insulation/ nicked wire conductor that exposed bare wire
  - Most probable cause was impact damage from portable scaffolding
- Harness assembly carries Crit 1R functions for SRB RSS



101pfr.4250.dd.10/99

ET/SRB Cross-Strap Harness Removal/Replacement

Discussion

- Decision made to remove and replace harness
  - +Y and -Y harnesses are bundled together
  - Easier to remove both harnesses rather than separate harnesses from each other

Rationale for Acceptance

- No design change required
  - Replacement per existing engineering requirements
- Test
  - DC continuity resistance of each ET/SRB cross strap harness
  - DC isolation resistance of ETSRB cross-strap harness from left (-Y) connector contacts to right (+Y) connector contacts
- Inspection
  - Inspection of cabling, connectors and clamps as part of Intertank egress
  - Pre-mate inspection of cable connectors

Effective tests/inspections in place to detect damaged hardware

101pfr.4250.dd.10/99

Agenda

Overview	Jim Feeley
Current Mission/External Tank Highlights	
ET-101 Mass Properties Status	Rick Spring
Changes	
Special Topics	
• STS-99/ET-92 Pre-Flight Review Action Item	Jim Feeley
– Critical Process Changes	
• Weld Instruction Card (WIC) Certification	Don Bolstad
• ET Electrical Harness Investigation	Leed Colon
• ET/SRB Cross-Strap Harness Removal/ Replacement	
Senior Management Review NCDs: None	
SRM&QA Assessment	***Mike Bankester***
KSC Processing	Juan Ramirez
Verification/Certification	Jim Feeley
Mission Unique Assessment	
Readiness Statement	
Appendices	
• A: Minor Changes	
• B: NCD Assessment Criteria	
• C: KSC Processing	
• D: Level II Exceptions/Waivers and Level III Deviations	
• E: Items previously reviewed for STS-99/ET-92	

101pfr.4250.dd.10/99

SRM&QA Assessment

as of 11/05/1999

Item	Status
ALERTS	None open
MRB Assessment	Complete - No issues/no impact to hazard controls
Hazard Assessment	Complete - All hazard reports were re-assessed and hazard controls verified
Corrective Action Problem Summaries (CAPS) • T-067PF, Loss of Intertank SOFI during Ascent of STS-87/ET-89 - Documents IFA STS-87-T-001 actions	• *Closed pending action* status submitted to MSFC

101pfr.4250.dd.10/99

Agenda

Overview	Jim Feeley
Current Mission/External Tank Highlights	
ET-101 Mass Properties Status	Rick Spring
Changes	
Special Topics	
• STS-99/ET-92 Pre-Flight Review Action Item – Critical Process Changes	Jim Feeley
• Weld Instruction Card (WIC) Certification	Don Bolstad
• ET Electrical Harness Investigation	Leed Colon
• ET/SRB Cross-Strap Harness Removal/ Replacement	
Senior Management Review NCDs: None	
SRM&QA Assessment	Mike Bankester
KSC Processing	***Juan Ramirez***
Verification/Certification	Jim Feeley
Mission Unique Assessment	
Readiness Statement	
Appendices	
• A: Minor Changes	
• B: NCD Assessment Criteria	
• C: KSC Processing	
• D: Level II Exceptions/Waivers and Level III Deviations	
• E: Items previously reviewed for STS-99/ET-92	

101pfr.4250.dd.10/99

KSC Processing - Status

as of 11/05/1999

Discrepancy Reports (DRs)/Problem Reports (PRs) Review

- All PR/MRB discrepancies/dispositions similar to previously flown vehicles
- All MRBs have been reviewed by MAF Reliability for potential SMR

Limited Life Component/ET Status

- All within required life through scheduled launch date plus 90 days

OMRSD Exceptions/Waivers: None

Removal/Replacement Activities

- Remove/replace composite nose cone
- Remove/replace ET/SRB cross-strap harness (Previously discussed as Special Topic)

Simulations

• Launch (S0044)	Complete - 10/18/1999
• Load (S0056)	Complete - 10/15/1999
• Mission Management Team	11/18/1999

KSC Processing - Status

as of 11/05/1999

ET modifications

• Mod Kits	
- DC&R	None
- Bldg 45	Remove/replace ET composite nose cone
- FEC	• Intertank thrust panel foam reduction • Intertank thrust panel foam venting • Extend Intertank thrust panel foam venting • Additional Intertank thrust panel foam venting and skin/stringer panel foam venting
• OMRSD/LCC	No new items **
• Software	None
• Facility	No new items **

** Previously presented for STS-92/ET-99 (Included in Appendix E)

101pfr.4250.dd.10/99

Agenda

Overview	Jim Feeley
Current Mission/External Tank Highlights	
ET-101 Mass Properties Status	Rick Spring
Changes	
Special Topics	
• STS-99/ET-92 Pre-Flight Review Action Item	Jim Feeley
– Critical Process Changes	
• Weld Instruction Card (WIC) Certification	Don Bolstad
• ET Electrical Harness Investigation	Leed Colon
• ET/SRB Cross-Strap Harness Removal/ Replacement	
Senior Management Review NCDs: None	
SRM&QA Assessment	Mike Bankester
KSC Processing	Juan Ramirez
Verification/Certification	***Jim Feeley***
Mission Unique Assessment	
Readiness Statement	
Appendices	
• A: Minor Changes	
• B: NCD Assessment Criteria	
• C: KSC Processing	
• D: Level II Exceptions/Waivers and Level III Deviations	
• E: Items previously reviewed for STS-99/ET-92	

101pfr.4250.dd.10/99

Verification/Certification

as of 11/05/1999

Item	Status
NSTS 07700, Volume X Baseline • Revision M, Change 254	No Issues
Certification documentation • Hardware Certification Sheets (HCS) • Certificates of Qualification (COQ)	Complete - No Issues
Waivers/Exceptions/Deviations	No new items

Mission Unique Assessment

as of 11/05/1999

Category/Item	STS-101
Review of MRB actions using updated loads	ECD 11/19/1999
MPS Preflight Prediction Package	ECD 11/19/1999

Readiness Statement

The External Tank, ET-101, is hereby certified and ready for STS-103 flight pending completion/closure of open and planned work

Terry L. Hibbard
Vice President, External Tank Project
Lockheed Martin Michoud Space Systems

101pfr.4250.dd.10/99

Appendices

A: Minor Changes

B: NCD Assessment Criteria

C: KSC Processing

- PR/MRB Summaries
- Modification Summaries/Status
- Limited Life Component Status
- Alternate Blowing Agent Usage at KSC
- Facility Modifications : No new items
- Software Changes: None
- OMRSD Exceptions/Waivers: None
- OMRSD Changes (RCNs): No new items

D: Level II Exceptions/Waivers and Level III Deviations

E: Items previously reviewed for STS-99/ET-92

Change Presentation Criteria

- Changes for Presentation
  - *Type I Documentation*
  - *Requirements*
  - *Configuration* (affects part interchangeability)
  - *Materials* (requires SE16 revision)
  - *Technical Changes to Processes* (STPs)
- Changes for inclusion in Appendix
  - *Minor configuration* (affects part interchangeability)
  - *Minor updates* - Does not affect part interchangeability, materials or processes
    - Revise point of incorporation
    - Drawing clarification
    - Non-flight hardware installation/removal
    - Datum changes
    - Update usage/List of Materials
    - Drawing incorporation errors
    - Manufacturing aid
    - Drawing errors
    - Fastener type/grip
    - Producibility
    - Update vendor list
    - Laboratory test procedures
    - Materials
- All Class I and Class II changes have been reviewed by the MSFC Resident Office
- All Class II STP/STM/Standard/Code sheet changes have been submitted to the MSFC Materials, Processes and Manufacturing Department for concurrence

Minor Configuration Changes

Description	Reason	Basis for Certification
Deletion of ET Range Safety Systems (B02010-047/-029)	▪ Deleted residual isolators and supports associated RSS installation	▪ Similarity
Increase base thickness of aft Orbiter fitting to eliminate custom shim (H35809-459)	▪ Reduction in web thickness on SLWT from LWT caused aft orbiter fitting installation problems ▪ Custom shim was an interim fix until fitting redesign was implemented	▪ Analysis ▪ Similarity

Minor Changes – Structure

Change No.	Description
B01982-B49	Increased material stock thickness by .005in because parts thinned down more than expected during stretch forming
B02022-046	Update SLWT Weld Acceptance Manual to incorporate results of allowables testing
B02024-013	Update Walking Load Limitations Document for ALWT
H35809-182	Corrected location of datum on LH2 cable tray support electronic drawing. Error during conversion from manual to electronic drawing
H35809-245	Clarified note on fairing assembly drawing to apply epoxy on non-adhesive side of tape
H35809-363	Revise vertical strut forging drawing to allow for the previously approved penetrant inspection Method D (post emulsified)
H35809-377	Deleted ultrasonic inspection requirement from outer chords due to thin chord material
H35809-404	Revise lower chord and bottom support chamfer drawing to better define chamfer and radius dimensions
H35809-457	Corrected cable tray support assembly optional washer from AN960PD416 to AN960KD416
H35809-469/ -478	Revised machined fitting drawing to agree with manual drawing. Error during conversion from manual to electronic drawing

Minor Changes – Structure

Change No.	Description
H35809-470	Removed dimension on LO2 tank and LH2 forward dome cap. Added note for depth of cut at weld land transition. Tolerance relaxation for producibility enhancement
H35809-544	Add nutplate holes sizes to Left and Right vertical strut to cable tray fairing drawing. Error during conversion from manual to electronic drawing
H35809-561	Clarified/added dimensions missing from machined thrust fitting drawing. Error during conversion from manual to electronic drawing
H35809-769	Revise dimension of forward level probe assembly from 3.210 max. to 3.220 max. to preclude NCDs. Part previously machined at detail level – Now machined at assembly level
H35809-791	Replace obsolete DA-15 (MA76A) sealant with a previously approved sealant Type III silicone paste (M660C)
H35809-814	Revised note to place tolerances in scribe lines for manufacturing use in aligning LO2 barrel panel welded assembly
H35809-854	Revise machined fairing assembly dimension (.42 constant to .42 +.06/ -.03) to allow new supplier to use numerically controlled program to build parts
H35809-859	Revise Frame 1973 to barrel 1 attach fittings tapped hole size and machined fitting end pad from 0.25" min. to 0.30" min.

Minor Changes – Structure

Change No.	Description
H35809-886	Add STP 2003 reference to drawing in addition to 100 degree countersunk fastener requirements
H35809-929	Revised view to extend vibro mark line past the theoretical weld line. Prevents rework to extend line if trim prior to weld removes entire line
H36809-233	Increased extrusion width due to not being able to meet minimum requirement after forming
H36809-253	Revised height dimension on drawing to include web thickness (dimension unchanged)
H36809-255	Corrected sheet numbers to eliminate duplicate sheet numbers
H36809-257	Clarify drawing to specify that no primer was required on part. Hardware built to requirements of this change
H36809-290	Revised drawings to reflect dimensional tolerances of new supplier of attach point castings
H36809-292	Added missing radius dimension. Error during conversion from manual to electronic drawing

Minor Changes – Propulsion/Mechanical

Change No.	Description
J31162-003, -004,-005, -006,-007, -008,-009, -010,-014, -016,-017, -018,-019, -020,-024	Reformatted tube drawings, created new development tube part numbers with the purpose of developing/incorporating new bend date to eliminate NCDs for interference on old tubes. No requirement, design, material or fitting
H35809-822/-824	Intertank pneumatic tubing installation drawing was clarified to update/clarify/reference correct details and change two screw length to make hardware installation consistent
H36809-239	Revise MAF surface acceptance criteria document to be consistent with supplier document

Minor Changes – TPS

Change No.	Description
H35809-962	Revised drawing to reinstate TPS sectional views that were inadvertently deleted by previous change
H36809-205	Revised MAF and Offsite Build Acceptance Criteria Manual to: • Add Inconel acceptance criteria and Kapton tape section • Delete foam materials no longer used • Reinstate "Part B" in-process rework requirements to Offsite manual • Minor documentation/format revisions
H36809-273	Corrected drawing sheet to reflect appropriate revision levels of graphic sheets

Minor Changes – Electrical

Change No.	Description
H36809-028	Revise Bill of Materials to specify correct RFI backshell. Correct RFI backshell that was called out on drawing notes was used
H50001-803/-804	Replaced copper conductor wire with soft copper conductor wire for ease of manufacturing

Minor Changes - Systems

Change No.	Description
B02024A-099 B02028-013 B02041A-033 B02059-009 H36809-309	Updates to CIL Implementation Drawing • Revised effectivities and added inspections due to ALWT Prime • Revised effectivities and added inspections due to Fairing Support Bracket design change • Revised effectivities and added inspections due to GUCA and ET GH2 Vent Disconnect redesign • Revised effectivities and added inspections due to Intertank Foam Venting design • Correct miscellaneous technical and non-technical errors
B02024A-100	Release ALWT Thermal Data Book
H36809-296	Revised ET Protection Requirements and Removal drawing to reflect the anti-static film requirement. No change to ET hardware - Documentation only

Minor Changes – Material Sciences

Change No.	Document	Description
H36809-314	EQTP 1003	• Delete obsolete materials (NCFI 22-65, CPR 488, PDL 4034, BX-250 Type II) • Delete GPC Test of Component A and replaced requirement with more accurate amine equivalent test • Change requirement for FTIR blowing agent peaks to "For information only" and use GC technique for improved accuracy

MRB Assessment Criteria

- Assessment of all MRB Items
  - Adequacy of technical dispositions
  - Completeness of required repair/retest
  - First time occurrences/SMR
  - Verification of margin of safety assessment/documented
  - Review of impact to hazards
  - Engineering review for impact to loads
  - Engineering review for reduced extrusion to plate weld allowables

ET-101 DR/PR/OMRSD Waiver/Exceptions

as of 10/27/99

System	Discrepancy	Problem	MRB Items
• Electrical	0	1	0
• Propulsion/ Pneumatics	1	3	0
• Structures	0	7	1
• Thermal (TPS)	0	12	5
Total	1	23	6

101pfr.4250.dd.09/99

ET-101 PR/MRBs, Structural

PR No./Status	Title/Description	Disposition
ET-101-ST-0004	During nose cone removal/ replacement noted suspect the alignment holes between the louver spacers and the vent horn sections	• Use as repaired – New pilot holes drilled to compensate for differences between original spacer and replacement spacer

ET-101 PR/MRBs, Thermal

PR No./Status	Title/Description	Disposition
ET-101-TS-0004	Void in the +Y bulkhead bracket PDL closeout at conathane bondline	• Repair with PDL
ET-101-TS-0005	Extended conathane cure at XT371 interface exceeded humidity requirements	• Humidity controlled until foam applied
ET-101-TS-0006	Low foam noted during sanding operations	• Use as repaired – Areas were blended • Thermal properties not affected
ET-101-TS-0007	Inadvertent venting of PDL	• Use as is • Testing demonstrates physical properties of foam not affected by venting • Vented PDL flown on STS-96/ ET-100

ET-101 PR/MRBs, Thermal

PR No./Status	Title/Description	Disposition
ET-101-TS-0009	• No PDL applied to aft fairing bolt hole	• Bolt hole closed out with PDL – Additional Conathane bondline acceptable for flight
	• Two areas of foam underfills at forward edge of aft fairing closeout	• Areas repaired using PDL – Additional Conathane bondline acceptable for flight

ET-101 KSC Modification Summary/Status

Modification No.	Description	Status
FEC KET-0048R1	Intertank thrust panel foam thickness reduction	Complete - 06/17/99
FEC KET-0054	Intertank thrust panel foam venting	Complete - 08/1/99
FEC KET-0054R1	Extend Intertank thrust panel foam venting	Complete - 08/19/99
FEC KET-0056	Intertank skin/stringer panel foam venting	Complete - 09/03/99

ET-101 Limited Life Components

Cycle Sensitive

Description	Part No.	Serial No.	Limit	Required	Remaining
LH2 Manhole Cover Assy	80914081488-509	0000650340	14	1	14
LO2 Tank Mechanical Assy	80912002000-500	0000691540	14	1	14
LH2 Tank Proof Test	80914002000-500	0000676100	14	1	14
LO2 Manhole Cover Assy	80911001205-509	0000696740	14	1	14
LO2 Fwd Ogive Cover Plate	80911001207-509	0000694300	14	1	14
LH2 Manhole Cover Assy – Aft	80911001444-509	0000684710	14	1	14
LH2 Tank Cap Closure Siphon	80911001445-502	0000717100	14	1	14

ET-101 Limited Life Components

Age Sensitive

Description	Part No.	Serial No.	Limit	Initiation	Expiration
External Tank	80901000000-500	00000094	6 Yrs	11/98	11/2004

ET-101 Limited Life Components

Age Sensitive Pyrotechnics - 10 Years Life/Requires Lot Verification Tests After 4 and 7 Years

Description	Part No.	Lot No.	Serial No.	Latest Retest	Expiration
Separator Assy GUCP	PD5000020-059	AAH	0001145	01/27/1998	01/2002
Cartridge Assy	PD5000020-030	AAH	0001292	01/17/1998	01/2002
Cartridge Assy	PD5000020-030	AAH	0001293	01/17/1998	01/2002

ET-101 Alternate Blowing Agent Usage at KSC

Foam	Document	Description	Location	Size
SS-1171	T5141	Aft hardpoint closeout	Xt 1973-2076, 180 degrees	4410 sq. in.
PDL-1034	T5249	ET/SRB aft fairing closeout	Xt 2058, 70/290 degrees	240 sq. in.
PDL-1034	T5244	ET/Orbiter jack pad closeout	Xt 1129, 15/345 degrees	9 sq. in.

SSP Waivers - Baseline

Document / Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 07700, Volume V - Information Management Requirements				
Generic part name, type, common designation, and part manufacturer H4 code are not required for EEE parts status print out	S00127B 06/28/88	Table C.5 Item 2SR-10	6	ETs 49 & up
Data required in limited life status report is supplied in acceptance data package	S00127B 06/28/88	Table C.6 Item 2SR-7	8	ETs 49 & up
Requirement to deliver element pressure vessel historical data to EPO will remain at contractor facility	S00127B 06/28/88	Table C.6 Item 2SR-7	10	ETs 49 & up

SSP Waivers - Baseline

Document / Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 07700, Volume X – Space Shuttle Flight and Ground System Specification, Book 1 Requirements				
Electrical wiring of redundant systems NSTS 08080-1, 20A/4B	S040732G 06/18/88	Table 2.0	362	ETs 23, 27-29, 31 & up
Soldering, circuit boards, and connectors	S040732M 09/09/88	3.6.15.1.1	379	ETs 23, 27-29, 31 & up
PD7400106 circuit boards	S040732M 09/09/88	3.6.15.2.1	382	ETs 23, 27-29, 31 & up
Pressure transducer circuit boards	S040732M 09/09/88	3.6.15.2.1	383	ETs 23, 27-29, 31 & up

SSP Waivers - Baseline

Document / Requirement	Authority	Paragraph	Waiver No.	Effectivity
NSTS 07700 Volume X – Space Shuttle Flight and Ground System Specification, Book 1 Requirements				
Debris prevention	S082962A 10/02/98	3.2.1.2.14	675	ETs 92, 97-105
Environmental acceptance of ET components	S002130H 03/07/89	3.7.1	13	ETs 23, 27-29, 31 & up
SL-E-0001 – Specification Electromagnetic Compatibility Requirement				
Wire marking is not applicable to the ET	S40732K 09/27/89	3.2.5	3	ETs 23, 27-29, 31 & up
SW-E-0002 – Ground Support Equipment General Design Requirements				
Factor of safety applied to yield for GUCP leg	S87020L 08/17/88	3.4.2.1	21	ETs 23, 27- 29, 31 & up

SSP Exceptions - Baseline

Document / Requirement	Authority	Paragraph	Exception No.	Effectivity
NSTS 08123 Certification of Flexible Hoses and Bellows				
LH2 feedline bellows	S005203G-R1 08/02/91	1.2	3	ETs 42-45, 47 & up

SSP Deviations - Baseline

Document / Requirement	Paragraph	Deviation No.	Effectivity
CPTO1M09A, External Tank Contract End Item Specification			
• Photographic evidence shows a loss of foam from both +Y and –Y Intertank Thrust Panels • Analysis concluded a low probability of debris impact on Orbiter critical area	3.2.5	233	ETs 92, 97- 99, 101-105

Items Previously Presented for STS-99/ET-92

- **Pad Facility Modification**
  - LO2 pump controller replacement

- **OMRSD**
  - Delete ET Intertank inspections and revise leak checks at KSC (KT13565A)
  - Revise tank pressure monitoring requirement and increase tank pressure lower limit (KT13566M)
  - Revise GUCP quick disconnect leak check methods (KT13576M1)
  - LO2 Orbiter/ET carrier plate purge pressure (KS13664M)
  - Tank pressure monitoring requirements (MT13625M/MS13626M)

- **Minor Changes**

Pad Facility Modification

- ***SSP58891 LO2 Pump Controller Replacement***
  - LO2 pump Robicon variable frequency drive (VFD) controllers were replaced with Allen Bradley VFDs
    - Installation and validation completed 7/2/99

Intertank Door Closeout OMRSD Changes, File IV

File IV

- Background
  - KSC Launch Flow Enhancement team requested Intertank door closeout prior to shipment to KSC
    - Results in flow savings of 5 serial days of ET standalone processing
  - MAF engineering revised to closeout Intertank door at MAF for ETs 93-95 and ET-106 and subs (B02049)
    - Several KSC inspections and leak checks would be deleted/revised as result of door closeout
  - KSC requested earlier deletion of inspection/leak checks to realize savings beginning with ET-92

Intertank Door Closeout OMRSD Changes, File IV

- Description of Change
  - Delete ET Intertank inspections and revise leak checks at KSC (KT13565A)
    - Changed inspections (nose cone and Intertank purge tube, electrical cabling, LH2 ullage pressure transducers) and internal GH2 vent valve sense line flow test to contingency to be performed only when Intertank access has been established
    - Replaced leak checks that are performed inside the Intertank (LO2 and LH2 tank pressure ports, GH2 pressurization line, LH2 tank feedthroughs) with leak checks performed external to the Intertank

- Rationale for Acceptance
  - Similarity - Intertank inspections and leak checks are performed at MAF prior to shipment to KSC
  - Approved by Level II PRCBD on 2/11/99 (S053293EJ)

Intertank Door Closeout OMRSD Changes, File IV

- Description of Change
  - Revise tank pressure monitoring requirement and increase tank pressure lower limit (KT13566M)
    - Extended tank pressure monitoring interval from once per week to within 14 calendar days of last reading as long as pressures are within specification during tank move operations
      - Intertank door closeout eliminates continuous monitoring of tanks during Orbiter mate
    - Increased tank pressure lower limit from 1.7 to 2.2 psig for additional assurance that tank pressure will not decay below minimum requirement

- Rationale for Acceptance
  - Adequate tank pressure is maintained
    - Historical pressures have not varied +/- 0.5 psig during VAB Integration Cell processing
  - Approved by Level II PRCBD on 2/11/99 (S053293EK)

Intertank Door Closeout OMRSD Changes, File IV

- Description of Change
  - Revise GUCP quick disconnect leak check methods (KT13576M1)
    - Change GUCP 3/8" quick disconnect leak checks to a non-intrusive method using the mass spectrometer at the pad instead of using a flow meter in the VAB
      - –GO2/GH2 vent valve, Helium inject, HGDS, Nose cone purge and Intertank purge
    - Acceptable leak rates were adjusted due to the sensitivity of the measuring device

- Rationale for Acceptance
  - Similarity - Revised leak check methods are adequate to detect leakage at the GUCP quick disconnects
  - Approved by Level II PRCBD on 2/11/99 (S053293EM)

LO2 Orbiter/ET Carrier Plate Purge Pressure

KS13664M

- Background
  - Purge pressure is required to establish plate gap pressure of 0.25 to 0.7 psig
  - Supply pressure for LO2 ET/Orbiter disconnect purge was below OMRSD limit of 375 psig during set-up on STS-95 (ET-98) and STS-96 (ET-100)
    - Waivers approved that accepted lower supply pressure based on analysis that indicated a tight system

- Description of Change
  - Revise minimum GSE supply pressure for LO2 Orbiter/ET carrier plate purge
    - Was: 375 psig
    - Now: 300 psig

- Rationale for Acceptance
  - Analysis
    - Lower set point pressure protects for adequate plate gap purge flow
    - Provides for dilution of an aft compartment LCC leak to below 25% O2 concentration with a factor of 4
    - 300 psig provides adequate protection against plate gap
  - Approved by Level II PRCBD on 7/16/99 (S053293KW)

Tank Pressure Monitoring Requirements

File IV and II, MT13625M/MS13626M

- Background
  - ETs previously shipped to KSC with psig tank pressure monitoring gages installed
    - Calibration inaccuracies in psig gages caused change to psia gages on ETs for shipment to KSC
  - After ET offload to the KSC VAB, the ET is monitored by KSC pressure monitoring system using psig gages

- Description of Change
  - Added tank pressure requirements in psia values for monitoring periods prior to gage installation in the KSC VAB

	psig		psia
• Tank pressure requirements	2.2-9.7	***OR***	16.9-24.4

- Rationale for Acceptance
  - Similarity - Positive tank pressure maintained
  - Approved by Level II PRCBD on 7/28/99 (S053293HH and S053293HF)

Items Previously Presented for STS-99/ET-92

Minor Class II Changes

Change No.	Description
Structural	
H34809-986	Added note on slosh baffle frame fitting to define number in brackets called out on the field of the drawing
H35809-886, 887, 888, 889	Corrected drawings missing reference to STP2003, countersink and flushness requirements
H35809-972	Revised primer application on upper aft ET/SRB fitting to touch up unprimed areas.
H36809-059	Revised Thermal Isolator Assembly drawing to assure proper application of J536 tape; issued rework DCN to apply tape to side opposite the assembly part number marking
H36809-060	Deleted references to spotface areas on the Intertank to LH2 Splice Installation; there are not spotface areas on drawing
Propulsion	
H36809-072	Added one fastener to list of materials
J31196-001 through -005	Revised helium inject installation to allow flex hose to meet the minimum bend radius requirement. Shortened tube lengths, created new spacer and revised tube bend data.

Items Previously Presented for STS-99/ET-92

Minor Class II Changes

Change No.	Description
TPS	
H35809-983	Added foam void acceptance criteria to LO2 Feedline support rib locations.
H35809-985	Added application of BX-250 per STP 1503 as an alternative to application of SS-1171 per STP 1536 for manual spray application process on LO2 dome
H35809-986	Revised minimum/maximum foam thickness at component build of the flex LO2 feedline to agree with venting inspections done at installation.
H36809-019	Added requirements to control the gap between Composite Nose Cone Seal (MA-25 ablator) and nose cone bulkhead brackets to prevent erosion of NCFI 24-124.
H36809-066	Revised LO2 PAL ramp configuration to eliminate less than adequate foam coverage over intertank stringer S7-3. This condition resulted from range safety deletion.
H36809-158	Clarify referenced dimension point of origin on LH2 tank flange at Sta. 1123.15.
H50001-799	Foam migration into adjacent acreage foam rind at Intertank flange foam closeouts; added optional foam closeout at Intertank stringer end

Items Previously Presented for STS-99/ET-92

Minor Class II Changes

Change No.	Description
H50001-800	Relax flushness requirement on LO2 tank plug pulls and to allow foam migration from plug pull repairs to crevices in acreage foam.
H50001-801	Revised LH2 Tank third hard point trim to allow for foam shadowing
TPS	
H50001-802	Revised LH2 aft dome cryoflex test panel to waive epoxy primer touch up not required out side test area
Electrical	
H50001-808	Replaced hard copper conductor wire with soft copper conductor wire for ease for manufacturing
Systems	
H36809-098	Clarified the type of shoe soles allowed Walking Loads Limitations document. Added drawing references, tools and associated graphics. Added note to specify limit on ladder tools.

Items Previously Presented for STS-99/ET-92

Minor Class II Changes

Change No.	Description
H36809-220	Revised ET measurement requirements to remove all references specifying how to measure the LH2 and LO2 tanks. Removed tool locations and numbers. Incorporated other minor corrections references.

Items Previously Presented for STS-99/ET-92

Minor Class II Changes

Change No.	Description
Systems	
H36809-262	Revised Acceptance Criteria documents to specify that atmospheric fallout type elements such as SOFI/Ablator dust and foam mist overspray particles produced during VAB acreage spray process are acceptable.
H36809-238	Revised Loads Data Book to include current database history for LWT/SLWT design and update specific components.
H36809-796	Revised ET Protection Requirements to: identify installation point for GO2 press. line and LO2 feedline fairing; delete protective wrap on bipod fittings and protective tools from nose cone cable tray fairing and louvers; revise GH2 vent line bellows cover to reflect as-built processing
J31176-011 & -017	Clarified ICD requirements on drawings; added reference to ICD 2-00001 on LO2 mechanical assembly and lug weld and LH2 aft dome cap drawings

Items Previously Presented for STS-99/ET-92

Minor Class II Changes - STPs/STMs/STDs/AVL

Change No.	Document	Description
H36809-167	STP6001 Adhesive Bonding	– Revised to refer to solvent wiping per STP5002 rather than specifying cleaning instructions within the bonding STP – Updated adhesive name from CREST 7450 to LORD 7450 to reflect vendor name change – *No change to processes or chemicals used*
H36809-190	1118 - Aluminum Alloy Plate and Sheet	– Moved callout for ultrasonic inspection per MIL-STD-2154 Class B for plate exceeding 2000 lbs from drawing to material code sheet – Added clarifying note requiring STM1701 for thickness range of .250 to .499 inch – Added AMS-QQ-A-250/30 as alternate spec for material composition/properties – *No change to material used*
H36809-202	STP 6514 – Wire Bonding to LH2 Interior	Removed optional cleaning material (Freon PCA) from list of materials. Isopropyl Alcohol (IPA) already listed as approved cleaning material

Items Previously Presented for STS-99/ET-92

Minor Class II Changes - STPs/STMs/STDs/AVL

Change No.	Document	Description
H36809-243	Y498 – Nitrogen Propellant & Press Agent	Replaced "Helium" inadvertently placed in code title with "Nitrogen"
H36809-261	N308 Drylube Lubricant	Revised code sheet to specify that one can per lot be shipped to MSFC for LO2 Compatibility Testing specimen preparation
B02041A-015	62A1 Stainless Steel Spring Wire	Released material code sheet for Type 302, Class 1 stainless steel spring wire; procurement specification ASTM A313